

DRAFT

# Sample Assessment Material

Certificate

## Level 1/Level 2 Certificate in Chemistry





Edexcel Certificate	
<h1>Chemistry</h1> <p>Paper: 1C DRAFT</p>	
Sample assessment material Time: 2 hours	Paper Reference(s)
	<b>KCH0/1C</b>
You must have: Ruler Candidates may use a calculator.	Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
- *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

## Information

- The total mark for this paper is **120**.
- ◀ • The marks for **each** question are shown in brackets  
- *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

NXXXXXX

# The Periodic Table of the Elements

1	2	Key										3	4	5	6	7	0
		relative atomic mass atomic symbol name atomic (proton) number															
7	9																
Li lithium 3	Be beryllium 4											11	12	14	16	19	20
												B boron 5	C carbon 6	N nitrogen 7	O oxygen 8	F fluorine 9	Ne neon 10
23	24																
Na sodium 11	Mg magnesium 12											27	28	31	32	35.5	40
												Al aluminum 13	Si silicon 14	P phosphorus 15	S sulfur 16	Cl chlorine 17	Ar argon 18
39	40																
K potassium 19	Ca calcium 20											70	73	75	79	80	84
												Ga gallium 31	Ge germanium 32	As arsenic 33	Se selenium 34	Br bromine 35	Kr krypton 36
85	88																
Rb rubidium 37	Sr strontium 38											115	119	122	128	127	131
												In indium 49	Sn tin 50	Sb antimony 51	Te tellurium 52	I iodine 53	Xe xenon 54
133	137																
Cs caesium 55	Ba barium 56											204	207	209	[209]	[210]	[222]
												Tl thallium 81	Pb lead 82	Bi bismuth 83	Po polonium 84	At astatine 85	Rn radon 86
[223]	[226]																
Fr francium 87	Ra radium 88											Elements with atomic numbers 112-116 have been reported but not fully authenticated					
												[272]	[271]	[268]	[277]	[264]	[266]
												Rg roentgenium 111	Ds darmstadtium 110	Mt meitnerium 109	Hs hassium 108	Bh bohrium 107	Sg seaborgium 106
												[272]	[271]	[268]	[277]	[264]	[266]
												Rg roentgenium 111	Ds darmstadtium 110	Mt meitnerium 109	Hs hassium 108	Bh bohrium 107	Sg seaborgium 106

\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

*The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.*

Answer ALL questions.

1. The table shows the properties of four substances.

Use the information in the table to answer the following questions.

Substance	Melting point in °C	Boiling point in °C	Conducts electricity when	
			solid	liquid
A	1650	2230	no	no
B	1538	2862	yes	yes
C	- 7	59	no	no
D	801	1413	no	yes

Place a cross (x) in the appropriate box to indicate your answer.

Choose from A to D a substance that could be:

(5)

- (a) a metal

☐ A☐ B☐ C☐ D

- (b) a giant covalent structure

☐ A☐ B☐ C☐ D

- (c) an ionic compound

☐ A☐ B☐ C☐ D

- (d) a liquid at 25°C

☐ A☐ B☐ C☐ D

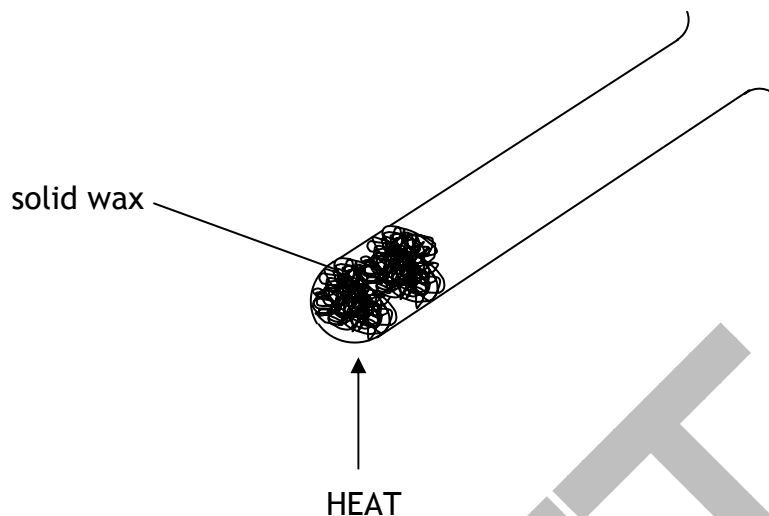
- (e) a solid at 1600°C

☐ A☐ B☐ C☐ D

(Total 5 marks)

2. Nimer investigated what happened when a sample of wax was heated.

He set up the apparatus as shown in the diagram.



Nimer heated the solid wax strongly with a Bunsen burner until it turned into a liquid.

(a) Give the name of the process when a solid turns into a liquid.

(1)

(b) Explain one change needed to make Nimer's experiment safer.

(2)

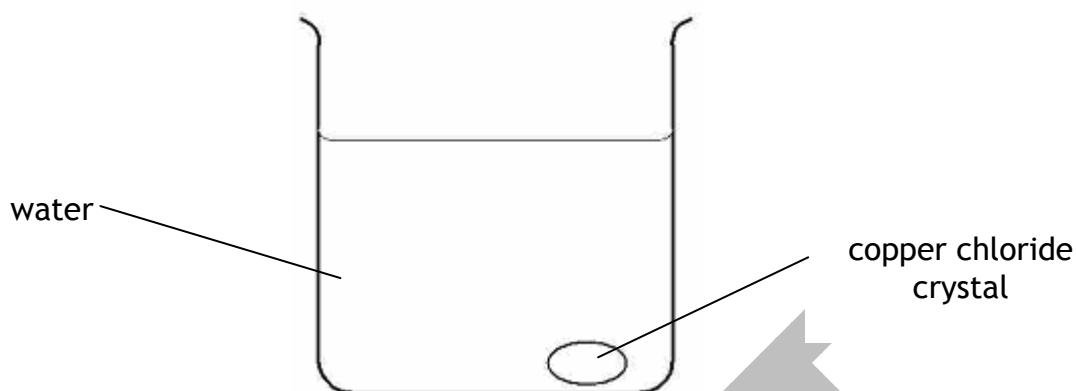
(c) Describe the changes in arrangement, movement and energy of the particles when the liquid wax cools to become a solid.

(3)

(Total 6 marks)

3. Copper chloride is a soluble ionic compound. Solid copper chloride is green.

- (a) A crystal of copper chloride was placed in a beaker containing water. It was left for several days.



Describe the appearance of the liquid in the beaker after several days.

(2)

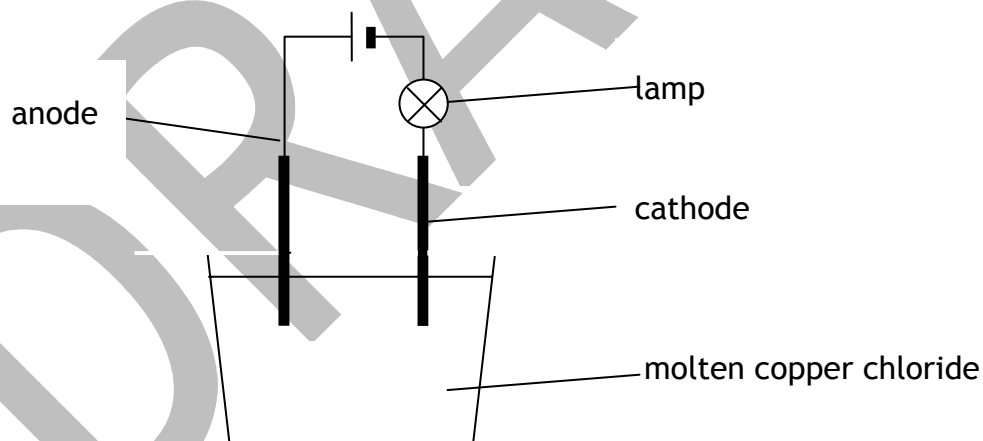
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- (b) A chemist electrolyses a sample of molten copper chloride,  $\text{CuCl}_2$ .



Name the products formed at the electrodes.

(2)

Anode .....

Cathode .....

- (c) Write an equation to show the formation of the product at the cathode.

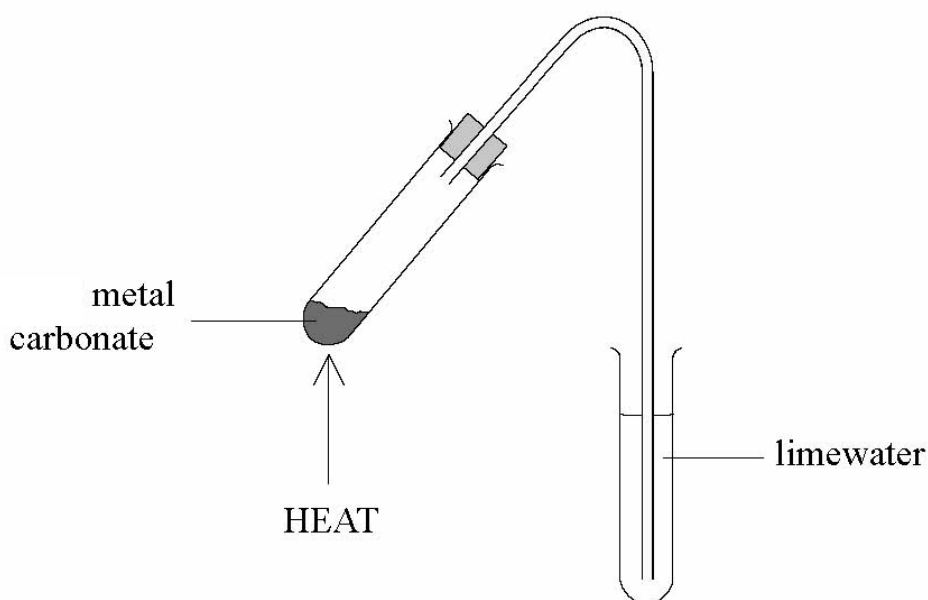
(2)

.....

(Total 6 marks)

4. A student wanted to find out how easily different metal carbonates decomposed on heating.

She placed a sample of a metal carbonate into a test tube and heated it, passing the gas given off through limewater using the apparatus shown in the diagram.



She heated three other metal carbonates in turn and measured the time taken for the limewater to turn milky.

Her results are given in the table.

Metal carbonate	Time taken in seconds
copper(II) carbonate	5
magnesium carbonate	25
lead(II) carbonate	15
sodium carbonate	does not turn milky



(a) State the name of the gas that causes the limewater to turn milky.

(1)

(b) Use the results to identify, with a reason, which metal carbonate decomposed most easily.

(2)

(c) What do the results suggest about the effect of heat on sodium carbonate?

(1)

(d) State **two** things that the student must do to make sure the experiment is valid (a fair test).

(2)

1

2

- (e) Another student suggested the results might be more accurate if she measured the time for a fixed volume of gas to be collected in a gas syringe.



Suggest why this might make the results more accurate.

(1)

(Total 7 marks)

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5. The first two members of the homologous series of alkenes are ethene,  $C_2H_4$ , and propene,  $C_3H_6$ .

(a) (i) What is the general formula of the alkenes?

(1)

(ii) Other than the same general formula, state **two** features of a homologous series.

(2)

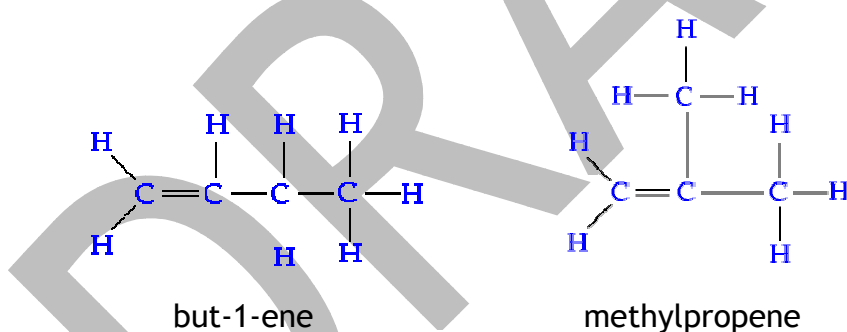
1 .....

2 .....

(b) Isomers are compounds that have the same molecular formula but different displayed formulae.

The molecular formula  $C_4H_8$  represents several isomers.

The displayed formulae and names for two of these isomers are

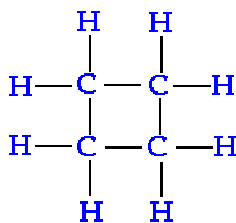


(i) Draw the displayed formula and give the name for another alkene with the molecular formula  $C_4H_8$ .

(2)

Name .....

(ii) The displayed formula of another isomer is



cyclobutane

Unlike the alkenes, cyclobutane is a saturated compound.

It can be distinguished from but-1-ene by adding bromine water and shaking. Bromine water is orange.

State what you would see when bromine water is shaken separately with each compound.

(2)

Observation with cyclobutane

.....

Observation with but-1-ene

.....

(c) Cracking is used to break long alkane molecules into shorter alkanes and alkenes.

Explain why this process is of such importance in the petrochemical industry.

(2)

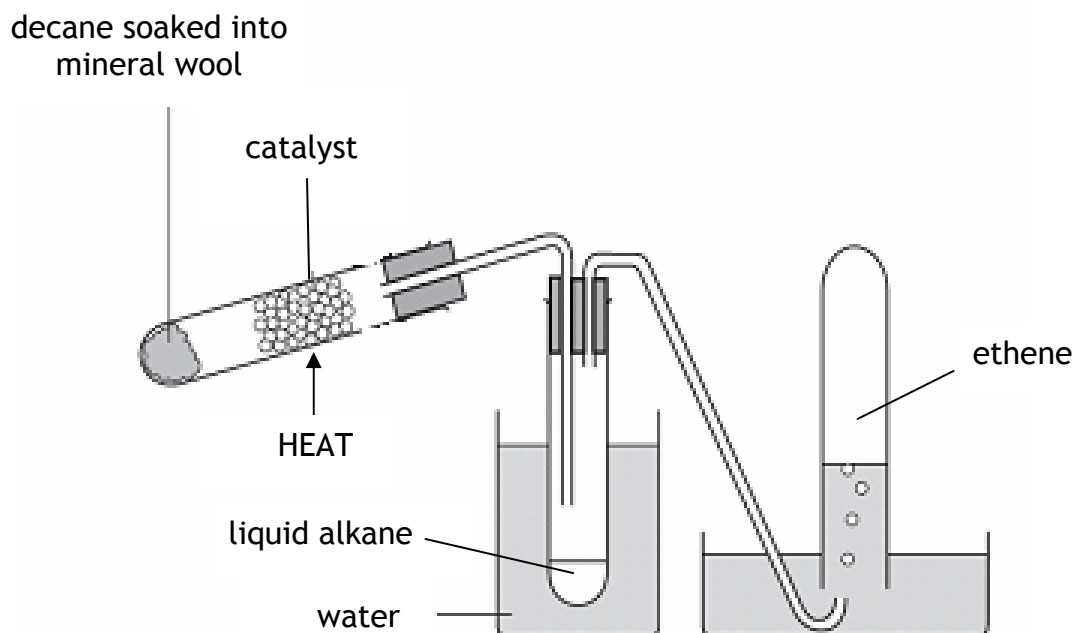
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(d) Cracking can be carried out in the laboratory by passing the vapour of an alkane over a heated catalyst using the apparatus shown.



When decane ( $C_{10}H_{22}$ ) is used, a shorter chain alkane and ethene ( $C_2H_4$ ) can be produced.

(i) Write a chemical equation for the cracking of decane.

(2)

(ii) The alkane produced can be used as a fuel for cars.

When this fuel is burned in a car engine, some incomplete combustion occurs. This produces carbon monoxide, which is dangerous to humans.

Explain why carbon monoxide is dangerous to humans.

(2)

(e) In car engines, two gases in air can react together to form oxides of nitrogen. These oxides can cause acid rain.

(i) Identify the two gases in air that can react together to form oxides of nitrogen.

(1)

(ii) Suggest the identity of an acid that forms when oxides of nitrogen dissolve in rain water.

(1)

(iii) State one problem caused by acid rain.

(1)

(Total 16 marks)

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6. Margaret goes on holiday to the seaside.

She notices some iron railings on the beach that are often in contact with the sea water. They are very rusty.

The iron railings in front of her hotel, some distance from the sea, are much less rusty.

Margaret predicts that sea water makes iron rust faster than rain water.

(a) Describe an experiment that Margaret could carry out to test her prediction.

(5)

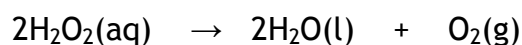
(b) Why is rusting described as an oxidation reaction?

(1)

(Total 6 marks)



7. (a) An aqueous solution of hydrogen peroxide,  $\text{H}_2\text{O}_2$ , decomposes very slowly into water,  $\text{H}_2\text{O}$ , and oxygen,  $\text{O}_2$ , according to the following equation:



The reaction occurs faster when manganese(IV) oxide,  $\text{MnO}_2$ , is added. The manganese(IV) oxide remains chemically unchanged at the end of the reaction.

The reaction was followed by measuring the volume of oxygen given off at intervals of five minutes. The results are shown in the table.

Time in minutes	0	5	10	15	20	25	30	35	40
Volume in $\text{cm}^3$	0	20	32	42	50	55	58	60	60

- (i) The volume of gas given off between 5 and 10 minutes is  $12 \text{ cm}^3$ .

Calculate the volume of gas given off between 30 and 35 minutes.

(1)

Answer .....  $\text{cm}^3$

- (ii) Explain, in terms of the changes in the rate of the reaction and collisions between particles, why your calculated volume is less than  $12 \text{ cm}^3$ .

(3)

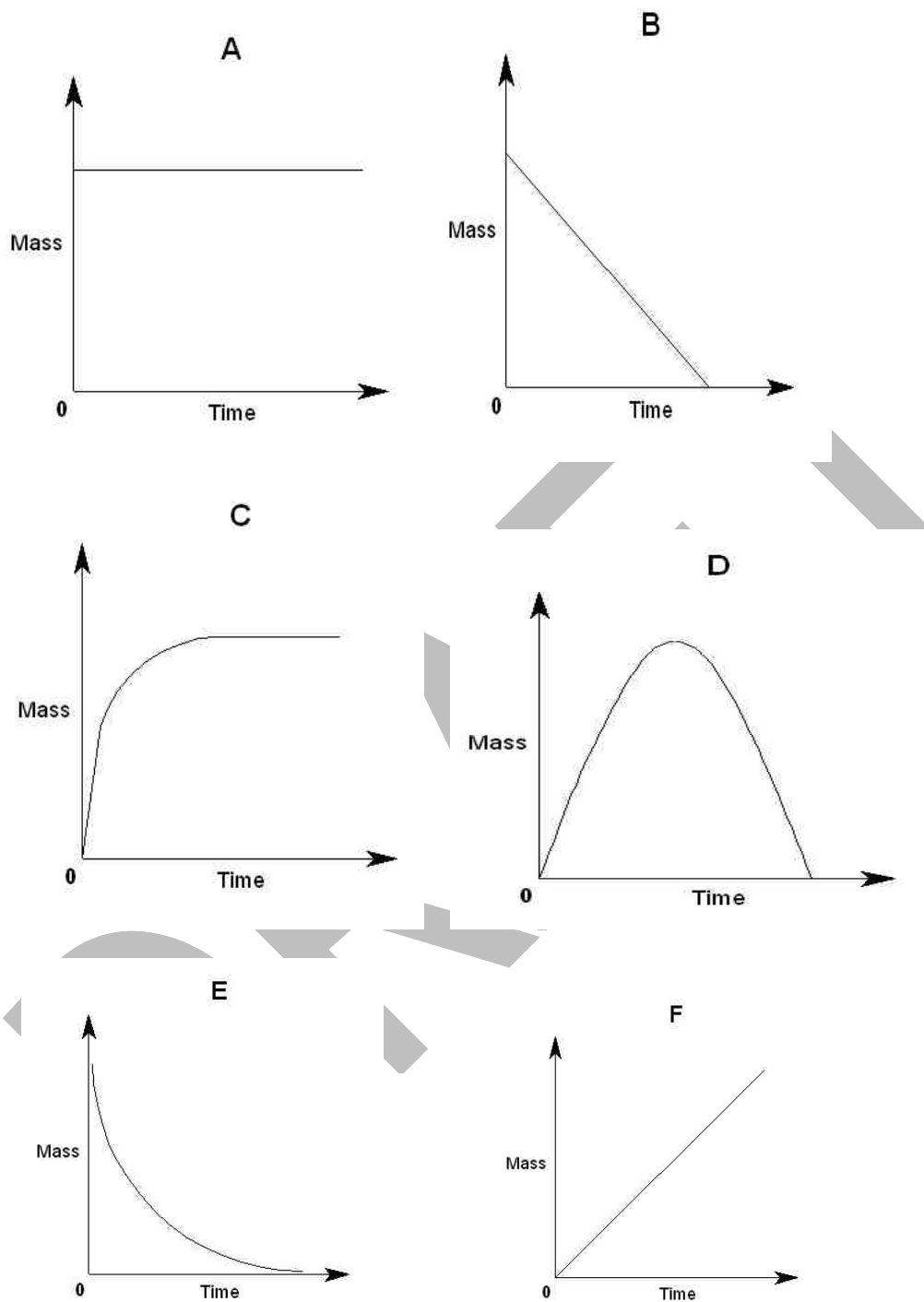
- (iii) After how many minutes did the reaction finish?

(1)

- (b) Describe the test for oxygen.

(1)

(c) Study the graphs A to F and answer the questions that follow.



Place a cross (x) in the appropriate box to indicate your answer.

Which graph could represent

(i) the total mass of oxygen given off as the experiment in (a) proceeds?

(1)

☐ A      ☐ B      ☐ C      ☐ D      ☐ E      ☐ F

(ii) the mass of hydrogen peroxide remaining as the experiment in (a) proceeds?

(1)

☐ A      ☐ B      ☐ C      ☐ D      ☒ E      ☐ F

(iii) the mass of the manganese(IV) oxide as the experiment in (a) proceeds?

(1)

☐ A      ☐ B      ☐ C      ☐ D      ☐ E      ☐ F

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(Total 9 marks)

8. Equal masses of iron, magnesium and zinc were placed in separate beakers, each containing 50 cm<sup>3</sup> of copper(II) sulfate solution.

The mass of copper displaced in each case was found and each experiment was performed three times. The results obtained are given in the table.

Metal	Mass of copper produced in grams		
	Experiment 1	Experiment 2	Experiment 3
iron	1.1	1.3	1.2
magnesium	2.3	3.2	2.2
zinc	0.9	0.8	1.0

- (a) Draw a circle around the result in the table that appears to be anomalous.

(1)

- (b) Write a chemical equation for the reaction taking place between magnesium and copper(II) sulfate.

(2)

- (c) (i) State, in terms of electrons, what happens when copper ions become copper atom.

(1)

- (ii) What name is given to the type of change occurring in (c)(i)?

(1)

- (iii) State two observations you would expect to make when magnesium is added to copper(II) sulfate solution.

(2)

(Total 7 marks)

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9. Zinc phosphide,  $\text{Zn}_3\text{P}_2$ , is found in some rat poisons. It is an ionic compound manufactured by heating zinc and phosphorus together.

(a) (i) The formula of the zinc ion is  $\text{Zn}^{2+}$ .

Deduce the formula of the phosphide ion.

(1)

(ii) Explain why zinc phosphide does **not** conduct electricity when solid, but **does** when molten.

(2)

(b) Calculate the relative formula mass ( $M_r$ ) of zinc phosphide.

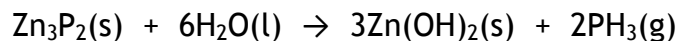
(2)

Relative formula mass = .....

- (c) A bag containing 51.4 kg (51 400 g) of zinc phosphide stored in a factory warehouse was accidentally contaminated with water.

Zinc phosphide reacts with water to form zinc hydroxide and phosphine gas,  $\text{PH}_3$ .

The equation for the reaction is:



- (i) Calculate the minimum mass of water, in kg, needed to react with all of the zinc phosphide in the bag.

(3)

Mass of water needed = ..... kg

- (ii) The factory was evacuated because phosphine can burst into flames immediately it comes into contact with oxygen in the air.

What does this suggest about the activation energy for the reaction between phosphine and oxygen?

(1)

- (iii) Is the reaction between phosphine and oxygen endothermic or exothermic? Use information from part (ii) to justify your answer.

(1)

- (d) (i) Phosphine is similar to ammonia,  $\text{NH}_3$ , in the way its atoms are bonded.

Draw a dot and cross diagram to show the arrangement of electrons in a molecule of phosphine. You should show only the outer electrons of each atom.

(2)

- (ii) Explain why phosphine has a low boiling point.

(2)

(Total 14 marks)



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10. The gas hydrogen chloride, HCl, dissolves in both water and methylbenzene.

The solution in water turns blue litmus paper red.

The solution in methylbenzene has no effect on blue litmus paper.

(a) Complete the following table to show the effect that each of the two solutions has on both magnesium ribbon and marble chips (calcium carbonate).

(3)

Solid	Effect of HCl in water	Effect of HCl in methylbenzene
magnesium ribbon	1. bubbles of gas  2. ribbon disappears	..... ..... ..... .....
marble chips	1. .... ..... ..... 2. .... ..... .....	no effect

(b) (i) A solution of hydrogen chloride in water contains two ions.

Give the **formula** of each ion.

(2)

..... and .....

(ii) Aqueous silver nitrate solution is were added to a solution of hydrogen chloride in water.

State an observation you would make in this reaction and **name** the substance formed that is responsible for this observation.

(2)

Observation

.....

Name of substance

.....

(iii) What is the name commonly given to a solution of hydrogen chloride in water?

(1)

.....

(Total 8 marks)

11. Fluorine and chlorine are two elements in Group 7 of the Periodic Table.

Fluorine reacts with most elements in the Periodic Table, but it does not react with neon.

Neon is in Group 0 of the Periodic Table.

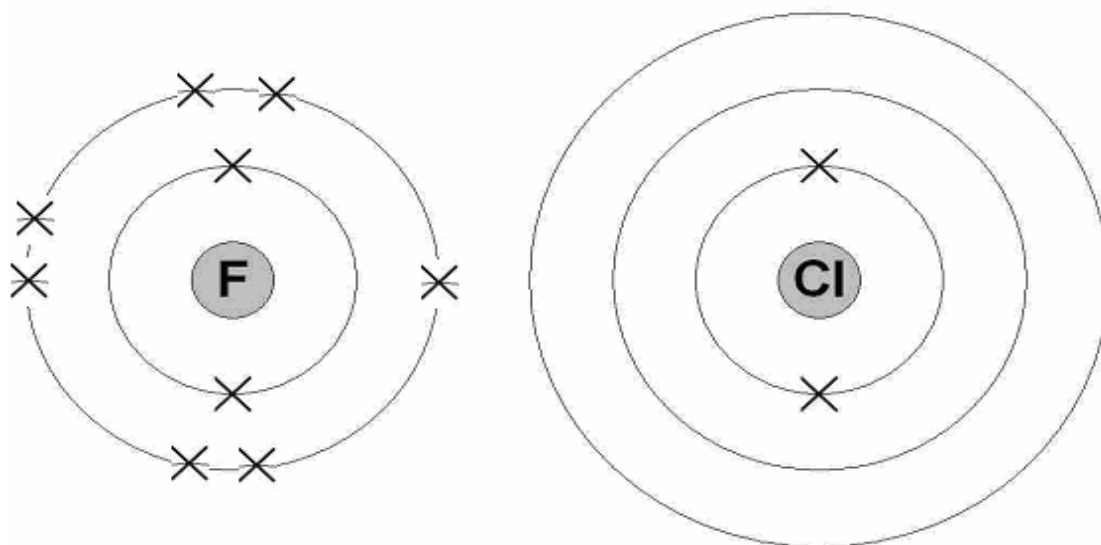
(a) Explain, in terms of the arrangement of electrons in its atoms, why neon is very unreactive.

(2)

(b) The diagram on the left shows the arrangement of the electrons in a fluorine atom.

Use the Periodic Table to help you to complete the diagram on the right to show the arrangement of electrons in a chlorine atom.

(2)



(c) When chlorine gas is bubbled into an aqueous solution of potassium iodide, the colourless solution turns brown.

- (i) Complete the following ionic equation for the reaction that takes place.

(2)



- (ii) What is the name given to this type of reaction?

(1)

- (iii) Why does the solution turn brown?

(1)

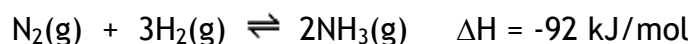
(d) When chlorine reacts with concentrated sodium hydroxide solution, a compound is formed that contains 21.6% by mass of sodium and 33.3% by mass of chlorine. The rest is oxygen.

Calculate the empirical formula of this compound.

(4)

(Total 12 marks)

12. Ammonia,  $\text{NH}_3$ , is manufactured in the exothermic reaction between nitrogen gas,  $\text{N}_2$ , and hydrogen gas,  $\text{H}_2$ , in the presence of an iron catalyst.



The nitrogen and hydrogen mixture is passed into a reaction chamber at a pressure of 200 atmospheres and a temperature of  $450^\circ\text{C}$ .

The reaction is reversible and, if left for long enough, can reach a position of dynamic equilibrium.

(a) Why is a catalyst needed in this reaction?

(1)

(b) What is meant by the term **reversible**?

(1)

(c) What is meant by the term **dynamic equilibrium**?

(2)

(d) A scientist working in the factory making ammonia suggested changing the reaction conditions to a pressure of 1000 atmospheres and a temperature of  $250^\circ\text{C}$ .

Use your knowledge of equilibrium reactions and reaction rates to explain whether the scientist's suggestion was a good one.

(4)

(e) The mixture of gases leaving the reaction chamber contains unreacted nitrogen and hydrogen as well as ammonia.

(i) Explain how the ammonia can be separated from the unreacted nitrogen and hydrogen after the mixture has left the reaction chamber.

(2)

(ii) What happens to the unreacted nitrogen and hydrogen after it has been separated from the ammonia?

(1)

(f) Ammonia is used to make the fertiliser ammonium nitrate,  $\text{NH}_4\text{NO}_3$ , by reacting ammonia with nitric acid.

Write a chemical equation for the reaction between ammonia and nitric acid.

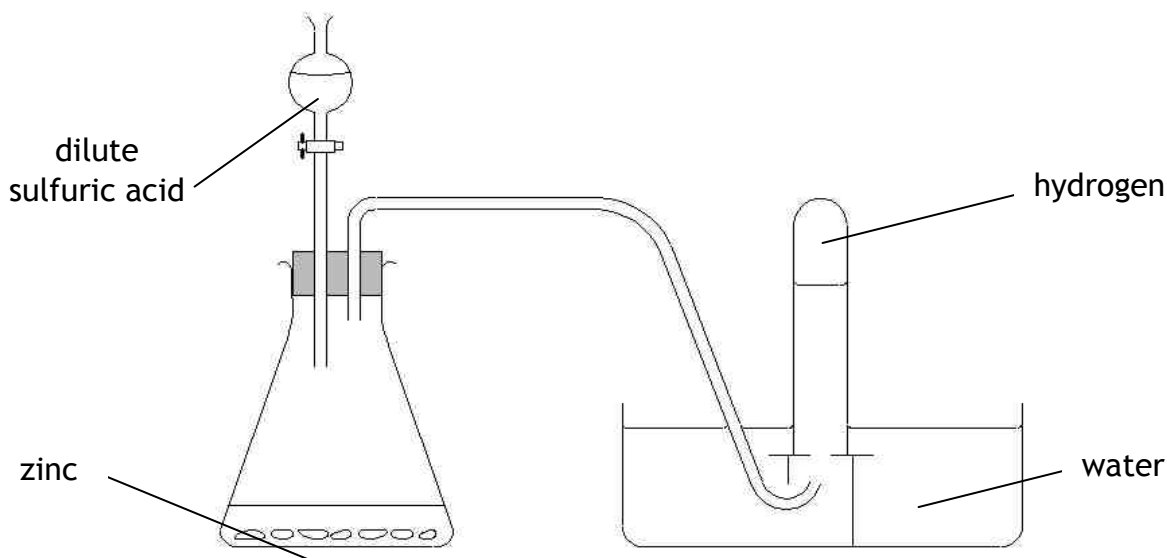
(1)

(g) Describe a chemical test that you could perform to show that ammonium nitrate contains ammonium ions.

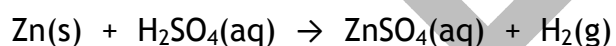
(3)

(Total 15 marks)

13. Hydrogen can be prepared in the laboratory by reacting zinc with dilute sulfuric acid using the apparatus shown.



The equation for the reaction is:



The reaction is fairly slow but, when copper(II) sulfate solution is added, bubbles of hydrogen form much more quickly.

A student decided to investigate how copper(II) sulfate solution increased the rate of this reaction.

She set up the apparatus as shown, without copper(II) sulfate present, and counted the number of bubbles of hydrogen produced every 15 seconds.

She then repeated the experiment with the copper(II) sulfate present.

- (a) Explain why her method of counting the number of bubbles of hydrogen might not give accurate results in her second experiment, with copper(II) sulfate present.

(2)



(b) Describe how should she change the experiment to allow the collection of more precise results.

(2)

.....

.....

.....

.....

.....

.....

The student then decided that she wanted to show that the gas collected was hydrogen. She burned a sample in oxygen and collected the colourless liquid that formed on cooling. If the gas were hydrogen then the colourless liquid should be pure water.

(c) Describe a **chemical** test that she could perform on the colourless liquid to show that water is present.

(2)

.....

.....

(d) Describe a **physical** test that she could perform to show that the colourless liquid is pure water.

(2)

.....

.....

The student's teacher said that even if the colourless liquid were pure water then it does not necessarily mean that the gas was hydrogen.

(e) Suggest the name of another **gas** that produces water when it is burned in oxygen.

(1)

.....

(Total 9 marks)

TOTAL = 120 marks

# Mark Scheme

## Sample assessment materials

Certificate

Chemistry (KCH0/1C)  
DRAFT

## General Marking Guidance

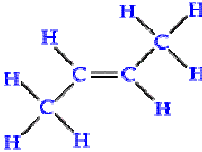
- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, ie if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Notes	Marks
1 (a)	B		1
(b)	A		1
(c)	D		1
(d)	C		1
(e)	A		1
			<b>Total: 5</b>

Question number	Answer	Notes	Marks
2 (a)	melting		1
(b)	<p>An explanation linking the following :</p> <ul style="list-style-type: none"> <li>• heat with electric heater / in water bath / sand bath</li> <li>• because wax may be flammable / prevent liquid wax boiling over or spitting</li> </ul>	<p>ACCEPT</p> <ul style="list-style-type: none"> <li>• use test tube holder / clamp</li> <li>• to prevent being burned by hot test tube</li> </ul>	2
(c)	<p>A description including the following:</p> <ul style="list-style-type: none"> <li>• (becomes) regular arrangement / pattern (of particles)</li> <li>• particles slow down / vibrate (in fixed positions)</li> <li>• particles lose (kinetic) energy</li> </ul>	<p>ACCEPT closer together</p> <p>ACCEPT stop moving around (freely)</p>	3
			<b>Total: 6</b>

Question number	Answer	Notes	Marks
3 (a)	liquid goes green evenly spread throughout beaker / due to diffusion		2
(b)	Anode = copper Cathode = chlorine	Award 1 mark for both correct products, but at incorrect electrodes	2
(c)	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	1 mark for correct species 1 mark for balance	2
			<b>Total: 6</b>

Question number	Answer	Notes	Marks
4 (a)	carbon dioxide	ALLOW CO <sub>2</sub>	1
(b)	copper(II) / copper (carbonate) (because) limewater turned milky in <b>least</b> time / <b>most</b> quickly		2
(c)	(sodium carbonate / it) does not decompose	ALLOW no carbon dioxide / gas given off	1
(d)	Any two from: <ul style="list-style-type: none"> <li>• same volume of limewater</li> <li>• same flame</li> <li>• same amount of solid</li> <li>• same distance of flame to tube</li> <li>• same form / state of division of solid (e.g. all powders, etc)</li> <li>• same concentration of limewater</li> </ul>	ACCEPT: same amount of limewater  same temperature / Bunsen setting  same mass of solid	2
(e)	less subjective/more objective/difficult to judge level of 'miliness'	NOT "instruments are more accurate"	1
			<b>Total: 7</b>

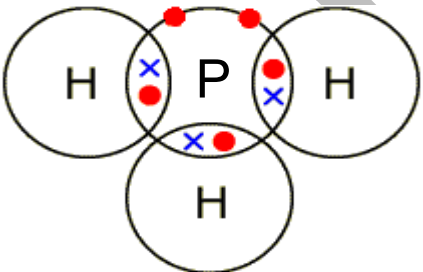
Question number	Answer	Notes	Marks
5 (a) i	$C_nH_{2n}$		1
ii	Any <b>two</b> from: <ul style="list-style-type: none"> <li>(neighbouring) members differ by <math>-CH_2-</math></li> <li>same / similar chemical properties</li> <li>gradation in physical properties</li> </ul>	ACCEPT same functional group	2
(b) i	 but-2-ene	1 mark for formula 1 mark for name	2
ii	cyclobutane: no change/remains orange but-1-ene: (bromine) turns colourless/decolourised		2
(c)	An explanation linking the following points: <ul style="list-style-type: none"> <li>crude oil contains too many long chain hydrocarbons</li> <li>which are economically less useful / need converting to more economically useful smaller hydrocarbons</li> </ul>	ACCEPT <ul style="list-style-type: none"> <li>alkenes need in polymer industry</li> <li>to make useful plastics</li> </ul>	2
(d) i	$C_{10}H_{22} \rightarrow C_8H_{18} + C_2H_4$ 1 mark for correct formula for alkane 1 mark for balanced equation	ALLOW equations which finish: $\rightarrow C_6H_{14} + 2C_2H_4$ $\rightarrow C_4H_{10} + 3C_2H_4$ $\rightarrow C_2H_6 + 4C_2H_4$	2
ii	An explanation linking the following points: <ul style="list-style-type: none"> <li>toxic / poisonous</li> <li>(because) it restricts blood carrying oxygen</li> </ul>	ACCEPT comments about binding to haemoglobin	2
(e) i	nitrogen and oxygen	ACCEPT $N_2$ and $O_2$	1
ii	nitric acid/ $HNO_3$	ACCEPT nitrous acid / $HNO_2$	1
iii	kills fish / aquatic life / trees / plants / damages buildings	ACCEPT leaches minerals from soil	1
			<b>Total: 16</b>

Question number	Answer	Notes	Marks
6 (a)	A description linking some of the following points: <ul style="list-style-type: none"> <li>• set up tubes containing iron in rainwater and iron in seawater</li> <li>• control tube / tube with iron and no water</li> <li>• same mass of iron / same volume of water</li> <li>• leave tubes for same length of time / stated time interval</li> <li>• method to measure rusting e.g. colour change / mass change</li> <li>• repeat experiment / more than one set of tubes set up</li> </ul>		5 max
(b)	involves gain / addition of oxygen	ACCEPT involves loss of electrons / increase in oxidation number	1
			<b>Total: 6</b>

Question number	Answer	Notes	Marks
7 (a) i	2		1
ii	An explanation linking the following points: <ul style="list-style-type: none"> <li>• reaction rate slows down</li> <li>• (because there are) fewer <b>hydrogen peroxide</b> particles</li> <li>• (therefore) less <b>frequent</b> collisions/fewer collisions <b>per second</b></li> </ul>	ACCEPT hydrogen peroxide is less concentrated	3
iii	35	ACCEPT a number <b>between</b> 30 and 35	1
(b)	relights a glowing spill/splint		1
(c) i	C		1
ii	E		1
iii	A		1
			<b>Total: 9</b>



Question number	Answer	Notes	Marks
8 (a)	circle drawn around 3.2 for Experiment 2 with magnesium		1
(b)	$\text{Mg} + \text{CuSO}_4 \rightarrow \text{MgSO}_4 + \text{Cu}$	1 mark for reactants 1 mark for products	2
(c) i	gains (two) electrons		1
ii	reduction		1
iii	Any <b>two</b> from: <ul style="list-style-type: none"> <li>(blue) colour of solution fades/solution turns colourless</li> <li>brown/pink/pink(y)-brown solid forms</li> <li>gets warm/hot</li> </ul>	NOT solution turns clear ALLOW precipitate ALLOW fizzing / bubbles	2
			<b>Total: 7</b>

Question number	Answer	Notes	Marks
9 (a) i	$P^{3-}$		1
ii	An explanation linking the following points: <ul style="list-style-type: none"> <li>ions are not free to move in solid (ignore reference to electrons)</li> <li>(however) ions are free to move when molten</li> </ul>	REJECT any mention of electron movement	2
(b)	$(65 \times 3) + (31 \times 2)$ = 257	Award 1 mark for correct use of Mr of Zn and P	2
(c) i	moles phosphine = $51400 / 257$ (1) moles water = moles phosphine $\times 6$ (1) mass water = moles water $\times 18 = 21600$ g / 21.6 kg (1)  OR  $6 \times 18 = 108$ (1) $257 / 108 = 51.4$ / mass water (1) mass water = 21.6 kg (1)	Mark consequentially on (b)  ACCEPT answer in g of kg, as long as unit matches value	3
ii	low/small		1
iii	(exothermic) because it burst into flames	ACCEPT heat is given out / produced	1
(d) i		1 mark for 3 bonding pairs 1 mark for non-bonding pair	2
ii	An explanation linking the following points: <ul style="list-style-type: none"> <li>weak (attractive) forces between molecules</li> <li>(therefore) little energy required to overcome forces / separate molecules</li> </ul>	ACCEPT "weak bonds", but not "covalent bonds"	2
			<b>Total: 14</b>

Question number	Answer			Notes	Marks
10 (a)					
	Solid	Effect of HCl in water	Effect of HCl in methylbenzene		
			No effect/none		
		1. bubbles of gas/effervescence/fizzing 2. calcium carbonate/lumps disappear			3
(b) i	H <sup>+</sup> Cl <sup>-</sup>			ACCEPT in either order	2
ii	white precipitate / solid silver chloride				2
iii	hydrochloric acid				1
					Total: 8

Question number	Answer	Notes	Marks
11 (a)	An explanation linking the following points: <ul style="list-style-type: none"> <li>8 electrons in <b>outer(most)</b> shell</li> <li>does not <b>easily/readily</b> gain or lose electrons</li> </ul>	ACCEPT full <b>outer(most)</b> shell ACCEPT argument based on energy required	2
(b)	8 electrons in middle shell 7 electrons in outer shell	ACCEPT dots, circles, crosses or e to represent electrons	2
(c) i	$2 \text{Cl}^- + \text{I}_2$	1 mark - correct formulae 1 mark - correct balancing	2
ii	displacement/redox	oxidation <b>and</b> reduction	1
iii	iodine	$\text{I}_2$	1
(d)	calculation of % O = 45.1 (1) dividing by Ar values: Na 21.6/23 Cl = 33.3/35.5 O = 45.1/16 (1) simplest whole number ratio = 1:1:3 (1) translating this ratio to a formula = $\text{NaClO}_3$ (1)		4
			<b>Total: 12</b>

Question number	Answer	Notes	Marks
12 (a)	to speed up the reaction <b>OR</b> to allow a lower temperature to be used but still have a reasonably / acceptably fast reaction	ACCEPT to lower the activation energy / achieve a better balance of yield and rate	1
(b)	can take place in both directions / can take place both forwards and backwards	ACCEPT reactants can change into products and vice versa	1
(c)	forward and reverse reactions <b>are</b> occurring at same rate/speed	ACCEPT amounts of reactants / products / macroscopic properties remain constant	2
(d)	<p>An explanation linking some of the following points:</p> <ul style="list-style-type: none"> <li>increased pressure favours forward reaction / increases yield</li> <li>increased pressure also increases rate</li> <li>decreased temperature favours forward reaction / increases yield</li> <li>decreased temperature decreases rate</li> <li>concluding comment e.g. greater yield, but probably at reduced rate / increase in rate due to pressure cancels decrease in rate due to temperature change</li> </ul> <p><b>Concluding comment must be present to allow full 4 marks to score - but may be either an agreement or disagreement with the scientist's idea.</b></p>	<p>ACCEPT moves equilibrium to right</p> <p>ACCEPT moves equilibrium to right</p> <p>ACCEPT good idea but increased pressure increases cost</p>	4 max
(e) i	An explanation linking the following points: <ul style="list-style-type: none"> <li>ammonia has low boiling point / liquefies</li> <li>(therefore) mixture is cooled</li> </ul>		2
ii	recirculated / recycled / re-used / returned to reaction chamber / used to make more ammonia		1
(f)	$\text{HNO}_3 + \text{NH}_3 \rightarrow \text{NH}_4\text{NO}_3$		1
(g)	A description linking the following points: add aqueous sodium hydroxide (and warm) <b>gas</b> (given off) turns (damp) red litmus blue	ACCEPT forms white smoke with hydrogen chloride	3
			<b>Total: 15</b>

Question number	Answer	Notes	Marks
13 (a)	An explanation linking the following points: <ul style="list-style-type: none"> <li>reaction rate is faster</li> <li>(therefore) counting bubbles is more difficult / bubbles may form continuous stream</li> </ul>	ACCEPT: <ul style="list-style-type: none"> <li>bubbles may be different size</li> <li>so not valid / poor comparison with first experiment</li> </ul>	2
(b)	A description linking the following points: <ul style="list-style-type: none"> <li>measure the volume of gas produced</li> <li>using a graduate test-tube / gas syringe / inverted measuring cylinder</li> </ul>	ACCEPT: answers which lead to decreased rate to allow bubble counting to work e.g. reduced concentration of acid / larger pieces of zinc	2
(c)	add to anhydrous copper(II) sulfate (colour changes) from white to blue	ACCEPT add to cobalt chloride paper from blue to red/pink	2
(d)	measure the boiling point / freezing point 100°C / 0°C	boils at 100°C OR freezes at 0°C is worth 2 marks	2
(e)	any named <b>gas</b> that burns in oxygen to form water as a product e.g. methane	ACCEPT correct formula for gas	1
			<b>Total: 9</b>



Edexcel Certificate	
<h1>Chemistry</h1> <p>Paper: 2C DRAFT</p>	
Sample assessment material Time: 1 hour	Paper Reference(s)
	<b>KCH0/2C</b>
You must have: Ruler Candidates may use a calculator.	Total Marks

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided  
- *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

## Information

- The total mark for this paper is **60**.
- ◀ • The marks for **each** question are shown in brackets  
- *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

NXXXXXX



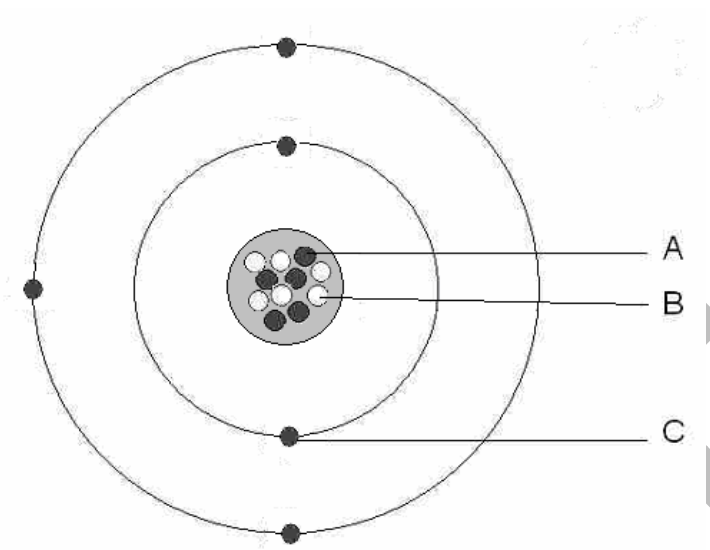
# The Periodic Table of the Elements

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\* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.  
The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.

Answer ALL questions.

1. The diagram represents an atom of an element.



(a) The diagram shows that there are equal numbers of particles A and C.

(i) State the name of each of the particles A and B.

(2)

A .....

B .....

(ii) State the atomic number and mass number of this atom.

(2)

Atomic number .....

Mass number .....

(b) (i) State the name of this element.

(1)

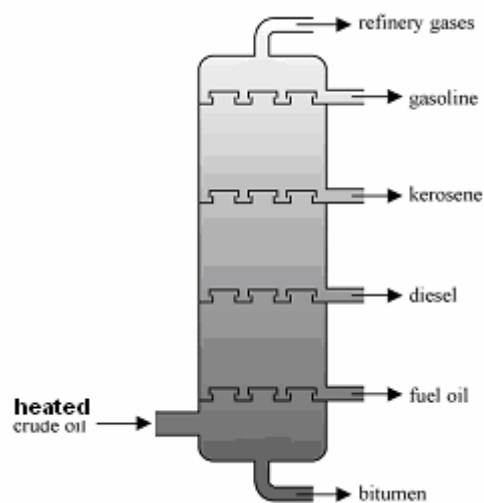
(ii) State the electronic configuration of this element.

(1)

(Total 6 marks)

2. Fractional distillation is an important process in the oil industry.

- (a) The diagram shows the column used for fractional distillation. In this process, the crude oil is separated into a number of fractions. Each fraction is a mixture of hydrocarbons.



- (i) What is meant by the term **hydrocarbon**?

(2)

- (ii) What property of the fractions allows them to be separated in this process?

(1)

(b) Bitumen, diesel and refinery gases are three of the fractions obtained from crude oil.

(i) Which of these three fractions has the lowest boiling point?

(1)

(ii) Which of these three fractions is the most viscous?

(1)

(iii) Name a different fraction that is a common source of fuel for aeroplanes.

(1)

(Total 6 marks)

3. Lithium sulfate,  $\text{Li}_2\text{SO}_4$ , is used in some medicines. The presence of lithium sulfate in a medicine can be shown by two tests.

(a) A flame test can be used to show that the medicine contains lithium ions.

State the colour that lithium ions produce in a flame.

(1)

(b) A sample of a medicine containing lithium sulfate is dissolved in water.

(i) Describe how you would test the solution for the presence of sulfate ions.

(3)

(ii) Write a chemical equation for the reaction occurring in (b)(i).

(2)

(Total 6 marks)

4. Polymers can be classified as addition polymers or condensation polymers.

(a) An addition polymer can be formed from the monomer  $C_3H_6$ .

(i) Name this monomer and the addition polymer it forms.

(1)

Monomer .....

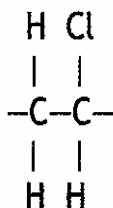
Polymer .....

(ii) Explain why there are problems with the disposal of addition polymers.

(2)

.....  
.....  
.....  
.....

(b) The repeat unit of a different addition polymer is shown below.



Draw the displayed formula of the monomer used to make this polymer.

(1)

(c) Nylon is an example of a condensation polymer.

Describe one difference between a condensation polymer and an addition polymer.

(2)

.....  
.....  
.....  
.....

(Total 6 marks)

5. Potassium chloride is a soluble salt. It can be prepared by reacting together solutions of potassium hydroxide and hydrochloric acid.

(a) A student did a titration to find the volume of hydrochloric acid needed to react with  $25.0 \text{ cm}^3$  of potassium hydroxide solution, KOH.

Exactly  $25.0 \text{ cm}^3$  of potassium hydroxide solution and a few drops of methyl orange indicator were added to a conical flask.

Hydrochloric acid was then added until a colour change was seen.

(i) State the type of reaction occurring between potassium hydroxide and hydrochloric acid.

(1)

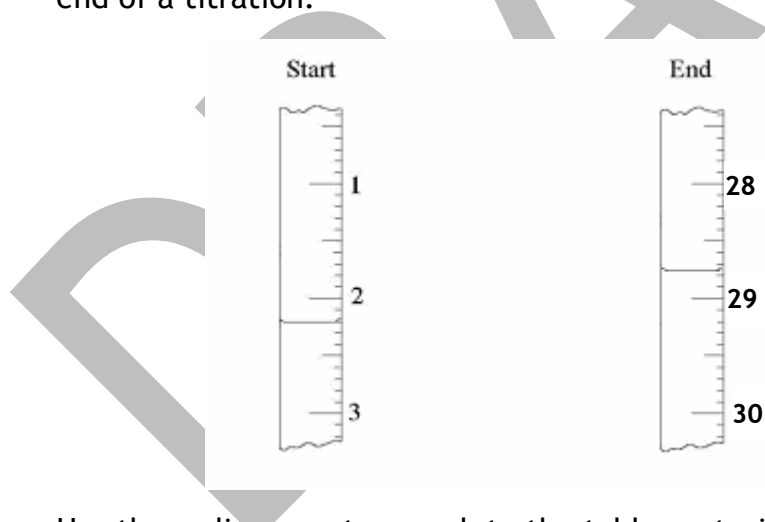
(ii) Write a chemical equation for this reaction.

(1)

(iii) State the final colour of methyl orange in the titration.

(1)

(iv) The diagrams show the readings on the burette at the start and at the end of a titration.



Use these diagrams to complete the table, entering all values to the nearest  $0.05 \text{ cm}^3$ .

(3)

Burette reading at end in $\text{cm}^3$	
Burette reading at start in $\text{cm}^3$	
Volume of acid added in $\text{cm}^3$	

(b) Another student did the titration and recorded these results.

Burette reading at end in $\text{cm}^3$	27.35	28.50	27.30	29.15
Burette reading at start in $\text{cm}^3$	0.20	1.80	1.20	2.65
Volume of acid added in $\text{cm}^3$	27.15	26.70	26.10	26.50
Titration results to be used (✓)				

(i) Concordant results are those that differ from each other by  $0.20 \text{ cm}^3$  or less.  
Identify the concordant results by placing ticks (✓) in the table as shown.

(1)

(ii) Use your ticked results to calculate the average volume of acid added.

(2)

Average volume = .....  $\text{cm}^3$

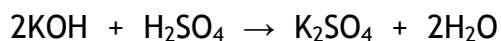
(c) Solid potassium chloride can be obtained from potassium chloride solution in a number of steps.

Describe the method you would use to obtain a pure, dry sample of potassium chloride from a dilute solution of potassium chloride.

(4)



(d) In another titration, some potassium hydroxide solution was neutralised by sulfuric acid. The equation for the reaction is



A  $25.0 \text{ cm}^3$  sample of  $0.200 \text{ mol/dm}^3$  potassium hydroxide was neutralised by  $28.40 \text{ cm}^3$  of sulfuric acid.

(i) Calculate the amount, in moles, of potassium hydroxide used.

(2)

(ii) Calculate the amount, in moles, of sulfuric acid used.

(1)

(iii) Calculate the concentration, in  $\text{mol/dm}^3$ , of the sulfuric acid.

(2)

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(Total 18 marks)

6. Ethanol can be manufactured by two different methods. The table gives some information about these two methods.

	Raw material	Quality of ethanol produced
Method A	crude oil	pure
Method B	sugar cane	impure

(a) In method A, ethanol is formed in the final step.

(i) Identify the **two** compounds that react together to form ethanol.

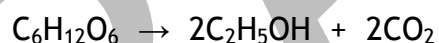
(2)

and

(ii) State **two** conditions used in this reaction.

(2)

(b) The equation for the reaction that occurs in method B is



(i) Name the compound with the formula  $\text{C}_6\text{H}_{12}\text{O}_6$ .

(1)

(ii) Identify the main impurity in the ethanol formed in this reaction.

(1)

(c) Some of the ethanol produced by method **B** is converted into ethene by heating it with a catalyst.

(i) Name the catalyst used in this reaction.

(1)

(ii) Name the type of reaction.

(1)

(iii) Write the chemical equation for this reaction.

(1)

(d) Some of the ethanol produced by method **B** is used as a fuel. Balance the chemical equation for the complete combustion of ethanol.

(1)



(Total 10 marks)

7. Lansfordite is the common name for a form of hydrated magnesium carbonate,  $\text{MgCO}_3 \cdot x\text{H}_2\text{O}$ .

This formula shows that lansfordite contains water of crystallisation. When a sample of lansfordite is heated gently, the water of crystallisation is given off and eventually anhydrous magnesium carbonate is left.

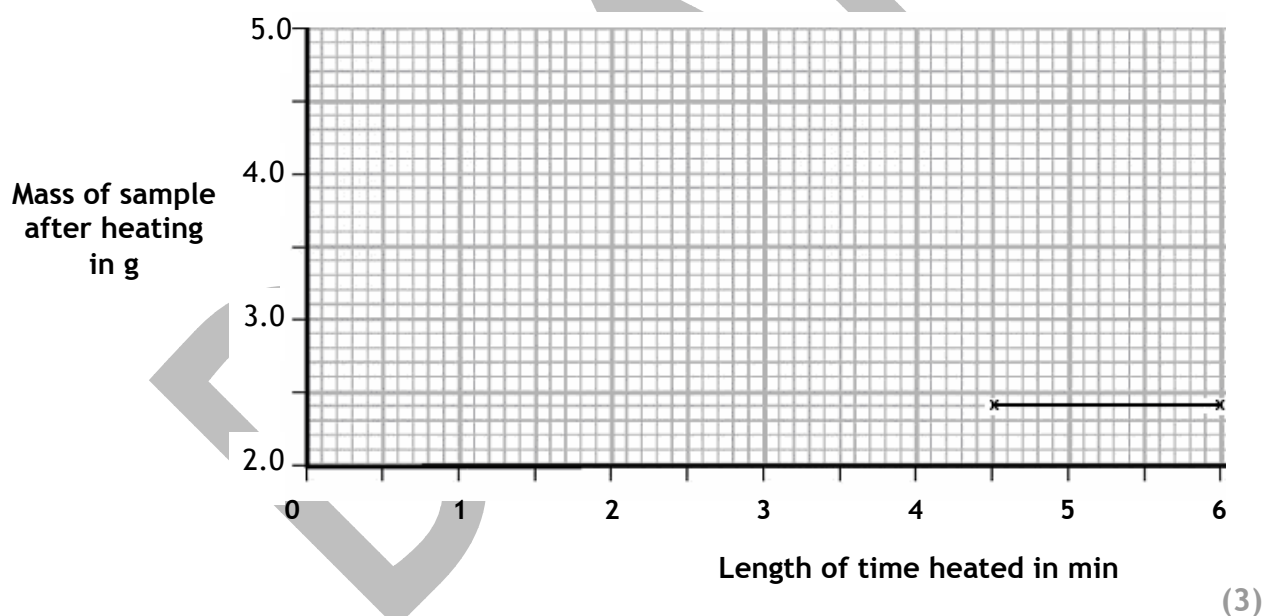
A teacher gave 5.0 g samples of powdered lansfordite to some students and told each student to heat the sample, then to let it cool and reweigh it.

The students heated the samples for different times. The teacher recorded their results in a table.

Length of time heated in min	0.0	1.0	3.0	3.5	4.0	5.0	6.0
Mass of sample after heating in g	5.0	4.4	3.3	3.0	2.7	2.4	2.4

- (a) Plot a graph of these results on the grid. The last two results have been plotted for you.

Draw a straight line of best fit through the points you have plotted.



- (b) Use your graph to predict the mass of a sample after heating for 2.0 minutes.

(1)

- (c) Suggest why the masses of the samples after heating for 4.5 minutes and after heating for 6.0 minutes were the same.

(1)

- (d) The teacher told one of the students that the amount of hydrated salt in a sample of lansfordite was 0.030 mol, and that the amount of water lost on heating was 0.15 mol.

Calculate the value of x in the formula  $\text{MgCO}_3 \cdot x\text{H}_2\text{O}$

(1)

- (e) When anhydrous magnesium carbonate is heated strongly it decomposes. The equation for the reaction is:



Calculate the volume, in  $\text{dm}^3$ , of carbon dioxide formed when 0.030 mol of anhydrous magnesium carbonate is completely decomposed.

(You may assume that the molar volume of a gas is  $24 \text{ dm}^3$ )

(2)

(Total 8 marks)

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**TOTAL MARKS = 60 MARKS**

# DRAFT

## Mark Scheme

### Sample assessment materials

Certificate

Chemistry (KCH0/2C)

## General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, ie if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.

Question number	Answer	Notes	Marks
1 (a) i	A = proton(s) B = neutron(s)	Award 1 mark for two correct particles in the wrong order	2
ii	atomic number = 5 mass number = 11		2
(b) i	boron		1
ii	2, 3	ACCEPT any other punctuation marks, such as , / ) – and no punctuation	1
			<b>Total: 6</b>

Question number	Answer	Notes	Marks
2 (a) i	compounds / substances containing hydrogen and carbon <u>only</u>	Do not accept atoms/elements in place of compounds/substances	2
ii	(different) boiling point(s)/boiling range(s)		1
(b) i	refinery gases		1
ii	bitumen		1
iii	kerosene		1
			<b>Total: 6</b>



Question number	Answer	Notes	Marks
3 (a)	red	IGNORE qualifiers such as pale / dark NOT 'brick red'	1
(b) i	barium chloride/barium nitrate (dilute) hydrochloric acid/nitric acid white precipitate	ACCEPT correct formulae  ACCEPT solid / suspension / ppt	3
ii	$\text{BaCl}_2 + \text{Li}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{LiCl}$	1 mark for formula of $\text{BaSO}_4$ 1 mark for rest of equation	2
			Total: 6

Question number	Answer	Notes	Marks
4 (a) i	monomer = propene/propylene polymer = poly(propene)/polypropylene	Both must be correct for 1 mark	1
ii	An explanation linking any <b>two</b> from: not biodegradable (because) they are inert (because) they have strong C-C / C-H bonds		max 2
(b)	$  \begin{array}{cc}  \text{H} & \text{Cl} \\    &   \\  \text{C} & = & \text{C} \\    &   \\  \text{H} & \text{H}  \end{array}  $	Ignore the geometry of the molecule	1
(c)	Any valid comparison ,eg Addition: only one type of monomer reacts with itself Condensation: two different monomers <b>OR</b> Addition: only one product formed Condensation: forms a bi-product / named bi-product	ACCEPT: differences in properties eg inert/breaks down when heated  REJECT: comparison of uses	2
			<b>Total: 6</b>

Question number	Answer	Notes	Marks
5 (a) i	neutralisation		1
ii	$\text{KOH} + \text{HCl} \rightarrow \text{KCl} + \text{H}_2\text{O}$		1
iii	orange	ACCEPT red	1
iv	28.75 2.20 26.55	3 <sup>rd</sup> mark consequential on other two	3
(b) i	ticks under 26.70 and 26.50		1
ii	$\frac{26.70 + 26.50}{2}$  = 26.6(0)	consequential on ticked results  2 <sup>nd</sup> mark consequential on 1 <sup>st</sup>	2
(c)	A description including any <b>four</b> from: <ul style="list-style-type: none"> <li>• heat/warm/boil</li> <li>• allow some/half/most of water to evaporate/evaporate until</li> <li>• crystallisation point reached</li> <li>• (allow to) cool/crystallise</li> <li>• filter/decant</li> <li>• dry on filter paper/leave in warm place/until water has evaporated</li> </ul>		max 4

Question number	Answer	Notes	Marks
5 (d) i	$\frac{0.200 \times 25.0}{1000}$ = 0.005(00)	2 <sup>nd</sup> mark consequential on 1 <sup>st</sup> IGNORE units	2
ii	0.0025	ACCEPT answer from (d)(i) ÷ 2	1
iii	$\frac{0.0025 \times 1000}{28.4}$ = 0.088(0)	2 <sup>nd</sup> mark consequential on 1 <sup>st</sup> IGNORE units and sig figs	2
			<b>Total: 18</b>

Question number	Answer	Notes	Marks
6 (a) i	ethene/C <sub>2</sub> H <sub>4</sub> water/steam/H <sub>2</sub> O	ACCEPT in either order	2
ii	Any <b>two</b> from: 300 °C (+ or - 50 °C) 60 - 70 atm phosphoric acid (catalyst)		max 2
(b) i	glucose		1
ii	water/H <sub>2</sub> O		1
(c) i	aluminium oxide	ACCEPT porous pot/conc sulfuric acid/conc phosphoric acid	1
ii	dehydration		1
iii	C <sub>2</sub> H <sub>5</sub> OH → C <sub>2</sub> H <sub>4</sub> + H <sub>2</sub> O		1
(d)	3 O <sub>2</sub> AND 2 CO <sub>2</sub> AND 3H <sub>2</sub> O	ACCEPT multiples	1
			<b>Total: 10</b>

Question number	Answer	Notes	Marks
7 (a)	all points plotted correctly to nearest gridline straight line through first 5 points	Deduct 1 mark for each error	2 1
(b)	Answer in range 3.8 - 3.9 (g)	consequential on candidate's line Units not needed, but do not award mark if incorrect units given	1
(c)	all water lost/same amount of water lost		1
(d)	5		1
(e)	$24 \times 0.03(0)$ $= 0.72 \text{ (dm}^3\text{)}$	Units not needed, but award max 1 if incorrect units	2
			<b>Total: 8</b>